

# **Installation of Infiltration Gallery at Greens Creek Mine – Juneau, Alaska USA**

**2013 Mine Water Solutions  
in Extreme Environments**

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# Alaska, USA



# Location of Greens Creek Mine on Admiralty Island



Greens  
Creek  
Mine



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# Admiralty Island



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# Location of Gallery



# Greens Creek



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# Old Water Supply System



- Three 1.2-m (48-in) diameter wells 1.2 m (4 ft) in height
- System minimum capacity of 3,800 m<sup>3</sup>/day
- Installed 1988
- Increased sediment pumping resulting in over 2 hours backwashing/day

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# Excavation of Old 48-in Wells



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# Screen with Airburst System



# Stilling Well



- The old wells were connected through a series of three, 12-in (305 mm) pipes to an 8-ft (2.4 m) diameter stilling well



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# Sump Pumps



- 3 pumps, each pump has a capacity in excess of 3,800 m<sup>3</sup>/day, allowing any one pump to meet peak demand and provide backup capacity.



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# Material Entering Old Wells



# Site Hydrogeology



- Quaternary alluvial, creek bed deposits of cobbles, gravel, and sand that are overlying landslide materials and relatively impermeable glacial tills and argillite
- The upper 4.6 m of streambed alluvium is comprised of well sorted cobbles, gravels and sands that is part of the active bed load.
- The sands and gravels have a thickness of 3- to 30-m and are underlain by relatively impermeable glacial till and argillites.
- Water from the deeper aquifers is highly mineralized and are not of quality suitable for potable water or mine processing.

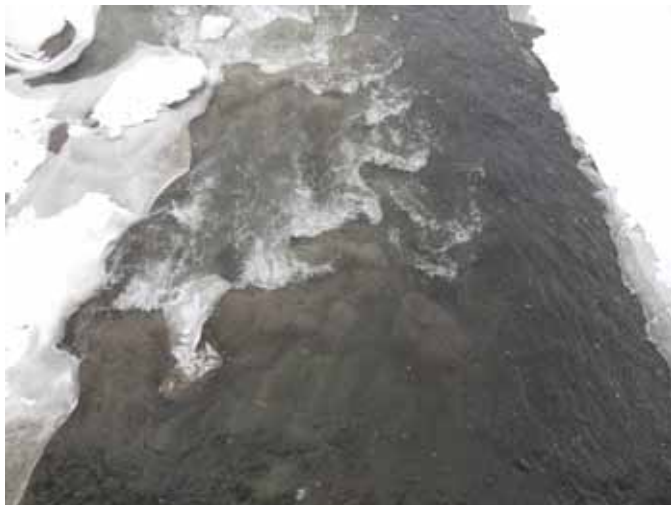
# Design Considerations



- Pumping sediment free water
- Installation below the augeis to prevent freezing and above the poor water quality
- Minimum of 3,800 m<sup>3</sup>/day during any time of the year
- Compatible with the existing stilling well and 305 mm (12-in) transmission pipes
- Work needed to be completed when salmon were not running and stream flow was low

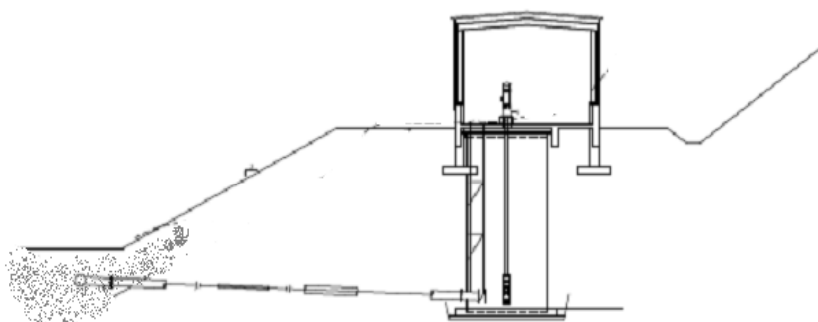
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# Aufeis Conditions



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# Cross Section of Infiltration Gallery





# Estimate of Length of Infiltration Gallery



$$L = \frac{0.366Q \log(1.1d / r)}{0.25KH}$$

Where:

- L = length of infiltration screen (m),
- K = hydraulic conductivity of gravel bed (m/day),
- H = submergence of infiltration screen (distance from stream surface to center of screen (m),
- d = distance from streambed to center of screen (m), and
- r = radius of well (m).

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# Infiltration Gallery Design Estimate



- Hydraulic conductivity of  $K = 400$  m/day (clean gravel),
- Submergence  $H = 2$  m,
- Distance to streambed  $d = 1.2$  m, and
- radius of well screen  $r = 0.25$  m and a anticipated pumping rate of  $3,800$  m<sup>3</sup>/day.

Estimated length of intake for the infiltration gallery of 19.1 ft (5.82 m)

# Screen Design



- The intake screens were designed by first ensuring:
- axial velocity of the intake was less than 0.9 m/sec (3 ft/sec ) and
- screen entrance velocity less than 0.1 ft/sec (0.03 m/sec) while allowing 50% blockage
- 9.14 m (30 ft ) of 22 x 20-in (559 – 508 mm) Muni-pak screen with a 2.5 mm (0.1-in) slot and 3.3- to 2.9-mm (0.13- to 1.1-in) diameter Sila Glass beads
- Glass beads were selected because they are more hydraulically efficient than natural gravels and are more resistant to biofouling that can clog well screens.

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# Muni-Pak Screens



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# Airburst Fittings



- The screens were equipped with a 2-in (51mm) air burst pipe
- The airburst pipe is centered in the middle of the screens and is perforated across the entire length opposite the screen openings



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# Airburst Piping



# Diversion of Greens Creek



- Maintain 3,800 m<sup>3</sup>/day water supply
- Divert water around infiltration gallery



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# Aqua Barrier Placed Above Excavation



- Build impoundment above excavation
- Pump water from impoundment to stilling well with flight pumps



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# Aqua Barrier in Place and Dewatering Downstream



- Aqua Barrier capable of impounding 2 m of water
- Flow need to be < 36,000 m<sup>3</sup>/day with no salmon present



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# Extracting Old Screen and Installing Muni-Pak



- Excavation to 2 m
- Water sumped from excavation at 4,100 m<sup>3</sup>/day to maintain dry working conditions



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# Connection of Gallery and Airlines



# Screens in Place



# Backfill with 1.6 cm Minus Material



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# Removal of Aqua Barrier



# Restored Creek Bed



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# Completed Project





# Completed Project



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# Extreme Animals



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